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10/737,374	12/16/2003	Roger Hansen	200312027-1	5369

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EXAMINER
TRUONG, LOAN

ART UNIT	PAPER NUMBER
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NOTIFICATION DATE	DELIVERY MODE
10/01/2009	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.
- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
  Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *08 June 2009*.

2a)☒ This action is **FINAL**.   2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-16,18-25,33,34 and 36-39* is/are pending in the application.

     4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *1-9,38 and 39* is/are allowed.

6)☒ Claim(s) *10-16,18-25,33,34 and 36-37* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

     Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

     Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

     a)☐ All   b)☐ Some * c)☐ None of:

        1.☐ Certified copies of the priority documents have been received.

        2.☐ Certified copies of the priority documents have been received in Application No. _____.

        3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

   * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1)☒ Notice of References Cited (PTO-892)

2)☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3)☐ Information Disclosure Statement(s) (PTO/SB/08)
     Paper No(s)/Mail Date _____.

4)☐ Interview Summary (PTO-413)
     Paper No(s)/Mail Date. _____.

5)☐ Notice of Informal Patent Application

6)☐ Other: _____.

FINAL ACTION

1.   This office action is in response applicant's argument filled June 08, 2009 in application
10/737,374.

2.   Claims 1-16, 18-25, 33-34 and 36-39 are presented for examination. Claims 1-2, 33-34
and 36-37 are amended. Claims 17, 26-32 and 35 are cancelled. Claims 38-39 are
newly added.

3.   Claim objection of claim 30 is moot in view of the cancellation.

Allowable Subject Matter

4.   Claims 1-9 and 38-39 are allowed.

The following is an examiner's statement of reasons for the allowance:

The examiner deemed claims 1-9 and 38-39 as novel when read as a whole for the
limitations of a system for storing checkpoint data comprising:

a persistent memory unit coupled to the network interface configured to receive
the checkpoint data into a region of the persistent memory unit via a remote direct
memory write command from a primary process and provide access to the checkpoint
data via a remote direct memory read command from a backup process wherein the
remote direct memory write command is preceded by a create request for the region and
the read command is preceded by an open request for the region.

Any comments considered necessary by applicant must be submitted no later than
the payment of the issue fee and, to avoid processing delays, should preferably

accompany the issue fee.   Such submissions should be clearly labeled "Comments on

Statement of Reasons for Allowance."

Response to Arguments

5.   Applicant's arguments filed June 8, 2009 have been fully considered but they are not

persuasive.

        In regard to claim 10, applicant stated that Beukema et al. does not teach the

limitation of "storing access information for the checkpoint data ... and providing the

access information to subsequent requestors of the checkpoint data."   Applicant argues

that Beukema et al. teaches of DMA read and write requests provide the R_Key to the

HCA hardware in contrast to claim 10 of providing the access information to subsequent

requestors.   Examiner disagree based the broadest interpretation of the claim language.

The limitation of storing access information and providing the access information to

subsequent requestor of the data can equate to Beukema et al. memory translation and

protection where virtual addresses are translates to physical addresses and validates

access rights (*paragraph 0040*).   The RDMA read work request provides a memory

semantic operation to read a virtually contiguous memory space on a remote node where

the memory region is defined by a virtual address and length (*paragraph 0046*).   One of

ordinary skill in the art would be able to interpret applicant's access information in its

broadest interpretation as Beukema et al. memory mapping of virtual address to physical

addresses.

In regard to claim 21, applicant stated that Beukema et al. does not teach the limitation of "providing access information to authenticated remote processors based on address protection and translation tables."   As mention above, Beukema et al. taught of a memory translation and protection mechanism where virtual addresses are translates to physical addresses and validates access rights (*paragraph 0040*).   The memory translation and protection mechanism does in fact provide access information and authentication as claimed by applicant.

In regard to claim 14 and 34, applicant stated that the limitation of "appending updated checkpoint data to at least one previous set of the checkpoint data" is not taught by St. Pierre et al. differential backup by the identified changed segments omitting at least on the segments that has not been changed would only apply that the checkpoint of St. Pierre et al. would includes only changed state data and not all state data.   Examiner disagreed with applicant that St. Pierre et al. does not teach the claimed limitation but agree with applicant that St. Pierre et al. differential backup would includes only changed state data to equate to applicant's updated checkpoint data.   The claimed limitation recited **updated** checkpoint data and not all state data.

In regard to claim 37, applicant stated that Chung et al. teaching of transmitting the last stored stated is not the same as applicant's previously unread portion.   Examiner disagree based on the broadest claim interpretation, the last stored state was not read by the backup process before the failure of the primary process and therefore reads on the claimed limitation.   Furthermore, applicant has not further defined what portion of the checkpoint data was retrieve previously since transmitting upon failure of the primary

process is the first communication of data retrieve and therefore, any data not retrieve

before the failure of the primary process can be viewed as unread.

For the reasons mention above, the rejections are maintained.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all

obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* v. *John Deere Co.*, 383 U.S. 1, 148 USPQ 459

(1966), that are applied for establishing a background for determining obviousness under 35

U.S.C. 103(a) are summarized as follows:

1.   Determining the scope and contents of the prior art.
2.   Ascertaining the differences between the prior art and the claims at issue.
3.   Resolving the level of ordinary skill in the pertinent art.
4.   Considering objective evidence present in the application indicating obviousness or nonobviousness.

6.   Claims 10-13, 18-19, 21, 25 and 36-37 are rejected under 35 U.S.C. 103(a) as being

unpatentable over Chung et al. (US 6,195,760) in further view of Beukema et al. (US

2002/0124117).

In regard to claim 10, Chung et al. teach a method for recovering the operational state of

a primary process, comprising:

writing checkpoint data regarding the operational state of the primary process

(*periodically receives from each fault-protected application module running on the network the*

most current state of that application, col. 4 lines 41-44) to the persistent memory unit

(*Checkpoint Server, fig. 1, 110, col. 4 lines 41-44)*; and

reading the checkpoint data from the persistent memory unit.

Chung et al. does not teach a method comprising: mapping virtual addresses of a

persistent memory unit to physical addresses of the persistent memory unit in a remote

direct memory write; remote direct memory read data subsequent to storing access

information for the data to the physical addresses of the data in the persistent memory

unit when the primary process opens a memory region for the checkpoint data; and

providing the access information to subsequent requestors of the checkpoint data.

Beukema et al. teach an Address Translation Table that defines the virtual-to-real

address mappings for the Memory Region (*paragraph 0061),* a RDMA read provides a

memory semantic operation to read a virtually contiguous memory space on a remote

node where a memory region references a previously registered set of virtually

contiguous memory addresses defined by a virtual address and length (*paragraph 0046),*

and where Bind Memory window provide the HCA hardware with the information

required to change the access rights of a Memory Window (*paragraph 0053-0054).*

It would have been obvious to modify the system of Chung et al. by adding

Beukema et al. infiniband memory windows management directly in hardware. A

person of ordinary skill in the art at the time of applicant's invention would have been

motivated to make the modification because it would allow better control access to

memory areas within a computer (*paragraph 0008-0009*).

In regard to claim 11, Chung et al. teach the method of Claim 10, further comprising:

providing context information regarding the addresses to the primary process and the backup

process. *It is inherent that the network of fig. 1 with the plurality of host computer H1-H6 if*

connected in an Ethernet network would have their own IP address to distinct one host computer

from another (col. 3 lines 60-67). Furthermore, the registration request from each failure-

protected application module included a list of the host computers on which the application

modules resided and where on each the executable program can be found (col. 4 lines 49-60).

In regard to claim 12, Chung et al. teach the method of Claim 10, further comprising:

reading the checkpoint data by the backup process upon failure of the primary process

(*Checkpoint server transmit last stored state to new primary application module, fig. 1, 110, H1-*

6, col. 4 lines 41-48).

Chung et al. does not teach remote direct memory reads.

Beukema et al. teach a RDMA read provides a memory semantic operation to

read a virtually contiguous memory space on a remote node where a memory region

references a previously registered set of virtually contiguous memory addresses defined

by a virtual address and length (*paragraph 0046*).

Refer to claim 10 for motivational statement.

In regard to claim 13, Chung et al. teach the method of Claim 10, further comprising: overwriting the checkpoint data with current checkpoint data (*when a failure of the primary application, the checkpoint data of the last stored state of the failed primary is supplied to the backup application module, col. 1 lines 49-57*).

In regard to claim 18, Chung et al. does not teach the method of Claim 10, further comprising: establishing a connection to a process requesting access to the checkpoint data; and binding the access information to the connection.

Beukema et al. teach a RDMA read provides a memory semantic operation to read a virtually contiguous memory space on a remote node where a memory region references a previously registered set of virtually contiguous memory addresses defined by a virtual address and length (*paragraph 0046*).

Refer to claim 10 for motivational statement.

In regard to claim 19, Chung et al. does not teach the method of Claim 10, further comprising: verifying authentication information from the subsequent requestors.

Beukema et al. teach the method of checking that the access rights specified for the Memory Region allow the access requested in the Bind (*paragraph 0058*).

Refer to claim 10 for motivational statement.

In regard to claim 21, Chung et al. teach a computer product, comprising: computer executable instructions embodied in a computer readable medium and operable to:

allow access to a persistent memory unit from a remote processor via a network (*last*

stored state is retrieved from the memory of Checkpoint Server connected to network, fig. 1, 110,

100, col. 4 lines 41-48);

store checkpoint data from a primary process (*periodically receives from each fault-*

protected application module running on the network the most current state of that application,

col. 4 lines 41-44); and

allow access to the checkpoint data for use in a backup process (*last operating state*

provided to the backup, col. 4 lines 34-40).

Chung et al. does not teach a computer product comprising: a remote direct

memory access references a persistent memory virtual address; authenticate requests

from remote processors, and provide access information to authenticated remote

processors based on address protection and translation tables in the persistent memory

unit; translate the virtual address to a physical address in the persistent memory;

Beukema et al. teach the method of RDMA read and write (*paragraph 0046 and*

paragraph 0048) and checking that the access rights specified for the Memory Region

allow the access requested in the Bind (*paragraph 0058)* where a bind remote access key

where the key is part of each RDMA access and is used to validate that the remote

process has permitted access to the buffer (*paragraph 0050)* and the L_key is used to

access the memory region's PTE which defines the characteristic of the Memory region

and references the Address Translation Table that defines the virtual-to-real address

mappings for the Memory Region (*paragraph 0061)*.

Refer to claim 10 for motivational statement.

In regard to claim 25, Chung et al. teach the system of Claim 21, wherein the persistent

memory (*Checkpoint Server, fig. 1, 110, col. 4 lines 41-44*) is configured as part of an access-

enabled system area network (*Checkpoint Server is connected to network, fig. 1, 110, 100*).

Chung et al. does not teach a remote direct memory access.

Beukema et al. teach of a RDMA read and write (*paragraph 0046 and paragraph*

0048).

Refer to claim 10 for motivational statement.

In regard to claim 36, Chung et al. teach the method of Claim 37, further comprising:

periodically transmitting the read command to retrieve at least a portion of the checkpoint data

for the backup process (*Checkpoint Server periodically receives from each fault-protected*

application module running on the network the most current state of that application, col. 4 lines

41-44).

Chung et al. does not teach the method comprising a remote direct memory access

read command.

Beukema et al. teach of a RDMA read and write (*paragraph 0046 and paragraph*

0048).

Refer to claim 10 for motivational statement.

In regard to claim 37, Chung et al. teach a method for retrieving the operational state of a

primary process, comprising:

transmitting a read command, to a remote persistent memory unit from a backup process

for the primary process processor (*backup for A application on multiple host computer, fig. 2, H2*

and H3), to retrieve previously unread portions of the checkpoint data upon failure of the

primary process (*Checkpoint server transmit last stored state to new primary application*

module, fig. 1, 110, H1-6, col. 4 lines 41-48).

  Chung et al. does not teach the method comprising a remote direct memory access

read command and receiving access information for physical addresses of the checkpoint

data in the persistent memory from the persistent memory unit.

  Beukema et al. teach of a RDMA read and write (*paragraph 0046 and paragraph*

0048) and an Address Translation Table that defines the virtual-to-real address mappings

for the Memory Region (*paragraph 0061)*, a RDMA read provides a memory semantic

operation to read a virtually contiguous memory space on a remote node where a memory

region references a previously registered set of virtually contiguous memory addresses

defined by a virtual address and length (*paragraph 0046)*, and where Bind Memory

window provide the HCA hardware with the information required to change the access

rights of a Memory Window (*paragraph 0053-0054)*.

  Refer to claim 10 for motivational statement.

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7. Claims 14-16 and 33-34 are rejected under 35 U.S.C. 103(a) as being unpatentable over

    Chung et al. (US 6,195,760) in further view of Beukema et al. (US 2002/0124117) in

    further view of St. Pierre et al. (US 6,141,773).

In regard to claim 14, Chung et al. and Beukema et al. does not teach the method of claim

10, further comprising: appending updated checkpoint data to at least one previous set of the

checkpoint data.

St. Pierre et al. disclosed the method of backing up and restoring data in a

computer storage system where differential backup is formed by the identified changed

segments omitting at least on the segments that has not been changed (*col. 5 lines 30-63*).

A differential bit file may be constructed including copies of only the changed data

segments (*fig. 13, 111a-111d*).   The differential bit file captures changes to a logical

entity as contiguous (*col. 17 lines 28-38*).

It would have been obvious to modify the method of Chung et al. and Beukema et

al. by adding St. Pierre et al. method of backing up data in a computer storage system

(*col. 5 lines 30-63*).   A person of ordinary skill in the art at the time of applicant's

invention would have been motivated to make the modification because it would permits

recovery from errors, including use of a mirror for data located at a remote facility that

also permits recoveries from catastrophic failure (*col. 5 lines 25-28*).

In regard to claim 15, Chung et al. teach the method of claim 10, further comprising:

clearing the portion of the multiple sets of checkpoint data (*periodically receives state updates

from the primary application module, col. 1 lines 64-67*).

In regard to claim 16, Chung et al. teach the method of Claim 14, further comprising:

allowing the backup process to read previously unread portions of the checkpoint data

upon failure of the primary process (*Checkpoint server transmit last stored state to new primary*

application module, fig. 1, 110, H1-6, col. 4 lines 41-48); and

resuming functions performed by the primary process with the back process (*checkpoint*

data of the last stored state of the failed primary application module is supplied to the backup

application module, col. 1 lines 52-58).

Chung et al. does not teach remote direct memory reads.

Beukema et al. teach a RDMA read provides a memory semantic operation to

read a virtually contiguous memory space on a remote node where a memory region

references a previously registered set of virtually contiguous memory addresses defined

by a virtual address and length (*paragraph 0046)*.

Refer to claim 10 for motivational statement.

In regard to claim 33, Chung et al. teach the method of Claim 34, further comprising:

overwriting the checkpoint data in the persistent memory unit with current checkpoint data.

(*when a failure of the primary application, the checkpoint data of the last stored state of the*

failed primary is supplied to the backup application module, col. 1 lines 49-57).

Chung et al. does not teach the method of a remote direct memory access write

command.

Beukema et al. teach a RDMA write provide a memory semantic operation to

write a virtually contiguous memory space on the remote node where the write wqe

contains a gather list of local and virtual address of the remote memory space into which

the local memory spaces are written (*paragraph 0048*).

Refer to claim 34 for motivational statement.

In regard to claim 34, Chung et al. does not explicitly teach the method for recording the

operational state of a primary process, comprising: a direct memory access write command; and

receiving access information for physical addresses of checkpoint data in the persistent memory

from the persistent memory unit.

Beukema et al. teach of a RDMA read and write (*paragraph 0046 and paragraph*

0048) and an Address Translation Table that defines the virtual-to-real address mappings

for the Memory Region (*paragraph 0061),* a RDMA read provides a memory semantic

operation to read a virtually contiguous memory space on a remote node where a memory

region references a previously registered set of virtually contiguous memory addresses

defined by a virtual address and length (*paragraph 0046),* and where Bind Memory

window provide the HCA hardware with the information required to change the access

rights of a Memory Window (*paragraph 0053-0054).*

Refer to claim 10 for motivational statement.

Chung et al. and Beukema et al. does not teach the method comprising appending

updated checkpoint data associated with the primary process to a previous set of the

checkpoint data stored in a persistent memory unit.

St. Pierre et al. disclosed the method of backing up and restoring data in a

computer storage system where differential backup is formed by the identified changed

segments omitting at least on the segments that has not been changed (*col. 5 lines 30-63*).

A differential bit file may be constructed including copies of only the changed data

segments (*fig. 13, 111a-111d*).   The differential bit file captures changes to a logical

entity as contiguous (*col. 17 lines 28-38*).

Refer to claim 14 for motivational statement.

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8.   Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chung et al. (US

6,195,760) in further view of Beukema et al. (US 2002/0124117) in further view of Ho et

al. (US 2002/0073325).

In regard to claim 20, Chung et al. disclosed the method of claim 10, further comprising:

a persistent memory manager (*Checkpoint Server, fig. 1, 110, col. 4 lines 41-44*) during

address protection and translation tables (*table, fig. 2, 200, col. 7 lines 1-5*) on the persistent

memory unit (*Checkpoint Server, fig. 1, 110, col. 4 lines 41-44*).

Chung et al. and Beukema et al. does not explicitly teach the method of

authenticating a persistent memory manager during initialization.

Ho et al. teach the method of authenticating software licenses by implementing a

persistent storage medium comprising a signature authentication program in the software

protection program (*paragraph 0023*).

It would have been obvious to modify the system of Chung et al. and Beukema et al. by adding Ho et al. method of authenticating software licenses. A person of ordinary skill in the art at the time of applicant's invention would have been motivated to make the modification because it would provide protection and allow legitimate backup copies (*paragraph 0011*).

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9.   Claims 22-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chung et al. (US 6,195,760) in further view of Beukema et al. (US 2002/0124117) in further view of Stiffer et al. (US 6,622,263).

In regard to claim 22, Chung et al. and Beukema et al. does not explicitly teach the computer product of claim 21, further comprising: computer executable instructions operable to: allow the processor to access address context information.

Stiffer et al. teach the method of checkpointing and fault recover software runs on standard platforms to detect observable malfunctions such as out-of-range address or exceeding a allocated range defined for a given data structure (*col. 4 lines 24-36).*

It would have been obvious to modify the system of Chung et al. and Beukema et al. by adding Stiffler et al. apparatus for achieving system-directed checkpointing without specialized hardware assistance. A person of ordinary skill in the art at the time of applicant's invention would have been motivated to make the modification because it

would establishing and recording a consistent system state from which all running

applications can be safely resumed following a fault (*col. 1 lines 13-17*).

In regard to claim 23, Chung et al. teach the computer product of claim 21, further

comprising: computer executable instructions operable to: Store multiple updates to the

checkpoint data sent at successive time intervals (*checkpoint technique to periodically take*

snapshots of the running state in a stable storage media, col. 1 lines 49-58).

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10.   Claim 24 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chung et al. (US

        6,195,760) in further view of Beukema et al. (US 2002/0124117) in further view of Wang

        (US 7,082,553).

In regard to claim 24, Chung et al. and Beukema et al. does not explicitly teach the

computer product of claim 21, further comprising: computer executable instructions operable to:

allow the backup process to access the multiple sets of the checkpoint data at one time.

        Wang teaches the for providing reliability and availability in a distributed

component object model object oriented system by implementing checkpoint request to

store current checkpoint of each object in registry image of disk storage (*fig. 8, col. 9*

lines 21-30).

        It would have been obvious to modify the method of Chung et al. and Beukema et

al. by adding Wang distributed component object model object oriented system.   A

person of ordinary skill in the art at the time of applicant's invention would have been

motivated to make the modification because it would help to quickly recover from a

failure (*col. 9 lines 30-46).*

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Conclusion

11.   The prior art made of record and not relied upon is considered pertinent to applicant's

disclosure. See PTO 892.

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time

policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE

MONTHS from the mailing date of this action. In the event a first reply is filed within TWO

MONTHS of the mailing date of this final action and the advisory action is not mailed until after

the end of the THREE-MONTH shortened statutory period, then the shortened statutory period

will expire on the date the advisory action is mailed, and any extension fee pursuant to 37

CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event,

however, will the statutory period for reply expire later than SIX MONTHS from the mailing

date of this final action.

Any inquiry concerning this communication or earlier communications from the

examiner should be directed to LOAN TRUONG whose telephone number is (571) 272-2572.

The examiner can normally be reached on M-F from 10am-6pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's

supervisor, SCOTT BADERMAN can be reached on (571) 272-3644. The fax phone number for

the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent

Application Information Retrieval (PAIR) system. Status information for published applications

may be obtained from either Private PAIR or Public PAIR. Status information for unpublished

applications is available through Private PAIR only. For more information about the PAIR

system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR

system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Loan Truong   /Scott T Baderman/
Patent Examiner   Supervisory Patent Examiner, Art Unit
Art Unit: 2114   2114